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STUDIES ON SUITABILITY OF BURNT RICE HUSK BASED POTTING MEDIUM FOR *SPATHIPHYLLUM*

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ABSTRACT

The study was conducted to evaluate the suitability of burnt rice husk (BRH)-based potting media for the growth and nutrient uptake of *Spathiphyllum*. Seven treatments were formulated: T₁ (60% cocopeat + 20% vermicompost + 20% BRH), T₂ (50% cocopeat + 20% vermicompost + 30% BRH), T₃ (40% cocopeat + 20% vermicompost + 40% BRH), T₄ (30% cocopeat + 20% vermicompost + 50% BRH), T₅ (20% cocopeat + 20% vermicompost + 60% BRH), T₆ (peat + perlite + vermiculite; 1:1:1), and T₇ (local nursery medium as control). Growth, physiological and substrate parameters were recorded over a duration of six months. Results revealed significant differences among treatments. T₁ recorded the highest nitrogen (4.09%) and phosphorus (0.38%) contents, superior root traits and a higher number of suckers, while T₆ excelled in plant height (37.33 cm) and SPAD values (65.40). T₅ exhibited maximum water-holding capacity (88.33%) and potassium content (4.23%), but supported lower growth performance. Local nursery medium (T₇) was inferior in organic carbon (0.87%) but supported moderate vegetative growth. These findings infer that the combination of 60% cocopeat, 20% vermicompost, and 20% burnt rice husk (T₁) provides a balanced medium for sustainable growth and nutrient uptake in *Spathiphyllum*, while peat–perlite–vermiculite medium (T₆) enhanced plant height and greenness.

Key words : *Spathiphyllum*, Burnt rice husk, Cocopeat, Vermicompost, Potting media, Nutrient uptake.

Introduction

Spathiphyllum, commonly known as peace lily, is a popular ornamental foliage plant appreciated for its aesthetic value and adaptability to indoor environment. It is a monocotyledonous flowering species from the family Araceae, native to tropical regions of the Americas and Southeast Asia (Safeena *et al.*, 2023). Notably, peace lily is among the few flowering plants recognized for its air-purifying abilities (Yang *et al.*, 2009).

The choice of potting media is crucial for the growth and development of indoor ornamental plants. Traditional materials like peat, perlite, and vermiculite are non-renewable and their extensive use raises sustainability concerns (Glenk and Martin-Ortega, 2018). This has led

to the exploration of alternatives from agricultural by-products, such as rice husk, coco peat, vermicompost. Rice husk and its biochar derivatives have proven to be effective and sustainable substitutes for traditional potting media. Sustainable soilless media are particularly important for export-oriented nurseries, ensuring ease of handling and compliance with international standards (Dubey *et al.*, 2012).

Rice husk and its biochar have been shown to enhance both plant growth and soil properties. Incorporating rice hulls into potting media has yielded promising results—for example, substituting 10% of expanded perlite with rice hulls improved cyclamen quality (Bonaguro *et al.*, 2017), while replacing 20% of peat

with a mixture of rice husk and leaf mold benefited chrysanthemum growth (Liu *et al.*, 2023). Beyond their role as potting substrates, rice husk and biochar positively influence soil health. Application of rice husk biochar significantly increased soil microbial biomass carbon ($408.66 \pm 0.57 \mu\text{g g}^{-1}$) (Singh *et al.*, 2018), while also enhancing soil organic carbon, nutrient availability (P, K, Ca), porosity, and water-holding capacity (Masulili *et al.*, 2010).

This study aimed to assess biochar from rice husk (BRH) as a component of nursery media for *Spathiphyllum*, focusing on its effects on growth, physiology, and nutrient uptake. The objective was to explore BRH-based substrates as sustainable alternatives to conventional potting media by evaluating plant performance and nutrient dynamics in amended formulations.

Materials and Methods

Location details

The experiment was carried out during 2024–2025 at the ICAR–Directorate of Floriculture, Regional Station, Vemagiri, situated at 16.91° N latitude and 81.43° E longitude. Seven potting media treatments were evaluated in a completely randomized design (CRD) with three replications.

Treatment details

T₁- 60% coco peat+ 20% vermicompost +20% burnt rice husk

T₂- 50% coco peat+ 20% vermicompost +30% burnt rice husk

T₃- 40% coco peat+ 20% vermicompost +40% burnt rice husk

T₄- 30% coco peat+ 20% vermicompost +50% burnt rice husk

T₅- 20% coco peat+ 20% vermicompost +60% burnt rice husk

T₆- coco peat +perlite + vermiculite (1:1:1)

T₇- Local nursery medium (control)

Parameters recorded

Growth parameters (plant height, number of leaves, number of suckers, leaf area, SPAD readings), physiological traits (water holding capacity, Total organic carbon, nutrient composition), and root characteristics were recorded periodically.

Number of leaves: Fully expanded leaves per plant were counted at monthly intervals after planting to assess vegetative growth. Plant height (cm) was measure from

the plant base to the tip of the longest leaf, Leaf area (cm²) was determined collecting the fully expanded leaves from each plant treatment wise and using leaf area meter total leaf area per plant was calculated, Number of suckers: Newly emerged suckers per plant were counted after six months of planting. Chlorophyll content was measured non-destructively with a SPAD meter from fully expanded leaves. Media density (g cm⁻³) was calculated by the cylinder method as oven-dried mass per unit volume. Water retention capacity (%) was estimated using the gravimetric saturation–drainage method. Root traits (length, diameter, surface area, volume, and dry weight) were analysed using WinRHIZO software after harvest. N P and K analysis: Harvested plant samples were shade-dried, oven-dried at 70°C, finely ground, and analysed. Nitrogen content was determined by the micro-Kjeldahl method (Piper, 1966). Phosphorus was estimated calorimetrically from di-acid digests (HNO₃: HClO₄, 9:4) using the vanadomolybdate method (Jackson, 1973). Potassium content was measured in the di-acid extract with a flame photometer (Jackson, 1973). Nutrient uptake was computed from nutrient concentration and total plant dry matter. Total organic carbon (TOC, %): TOC was estimated using a Total Carbon Analyzer (Shimadzu TOC-L, Japan). Samples were combusted at high temperature (900–1000°C) to convert organic carbon into CO₂, which was quantified by an infrared detector (Skjemstad and Baldock, 2008). The values were expressed as a percentage on a dry weight basis.

Statistical analysis

Data were analysed statistically in KAU GRAPES software.

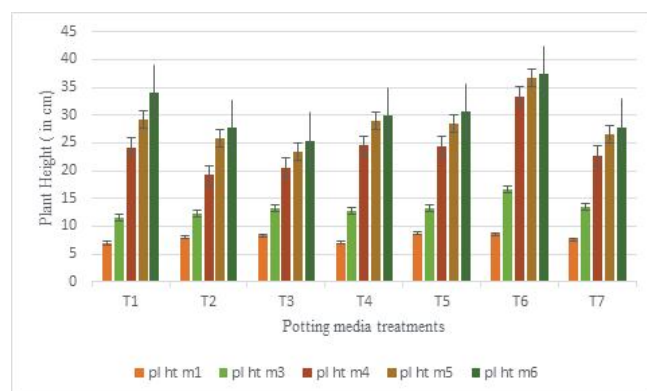
Results and Discussion

Media and plant growth

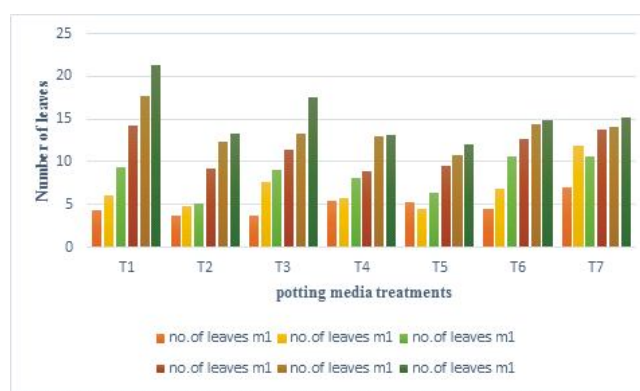
The composition of the potting media had a pronounced effect on the growth and physiological traits of *Spathiphyllum*. Media density (Table 1) varied from 0.64 g cm⁻³ in T₆ (peat: perlite: vermiculite) to 1.93 g cm⁻³ in the local nursery medium (T₇), while water retention (Table 1) was highest in T₅ (88.33%) and T₁ (68.66%). T₁ recorded lowest water retention. Highest Plant height (Fig. 1, Plate 1) was recorded in T₆ (37.33 cm), followed by T₁ (34.00 cm), while the lowest plant height was in T₃ (25.44 cm). Further T₁ recorded a greater number of leaves per plant (Fig. 2) (21.29) while T₅ produced the lowest number of leaves per plant (12.10). The greatest number of leaves (Fig. 2) was observed in T₁ (21.29), whereas T₅ produced the fewest (12.10). With respect to sucker production T₁ and T₇ produced significantly a greater number of suckers per plant and in T₂ had the

Table 1 : Effect of Potting Media Combinations on Growth Parameters in *Spathiphyllum*.

Treatment details	Media Density (g cm ⁻³)	Water Retention (%)	Plant height (cm)	Number of leaves	Number of Suckers	SPAD Readings	Leaf area (cm ²)
T ₁ : 60% CP + 20% VC + 20% BRH	0.96 ^b	68.66 ^e	34.00 ^b	21.29 ^a	4.38 ^a	63.56 ^a	57.59 ^c
T ₂ : 50% CP + 20% VC + 30% BRH	0.92 ^c	72.66 ^d	27.82 ^{cd}	13.37 ^{cd}	1.77 ^c	51.95 ^b	49.60 ^e
T ₃ : 40% CP + 20% VC + 40% BRH	0.89 ^d	79.33 ^b	25.44 ^d	17.49 ^b	2.33 ^c	48.65 ^b	39.86 ^f
T ₄ : 30% CP + 20% VC + 50% BRH	0.85 ^e	80.00 ^c	29.85 ^c	13.21 ^{cd}	2.11 ^c	49.56 ^b	40.40 ^f
T ₅ : 20% CP + 20% VC + 60% BRH	0.80 ^f	88.33 ^a	30.55 ^c	12.10 ^d	2.22 ^c	61.36 ^a	54.18 ^d
T ₆ : Peat : Perlite : Vermiculite (1:1:1)	0.64 ^g	78.66 ^c	37.33 ^a	14.90 ^c	3.10 ^b	65.40 ^a	85.36 ^a
T ₇ : Local nursery medium (control)	1.93 ^a	69.33 ^e	27.83 ^{cd}	15.17 ^c	4.10 ^a	60.09 ^a	67.81 ^b
SEm±	0.00	0.90	0.93	0.73	0.20	1.88	0.20
CD (p=0.05)	0.00	2.72	2.82	2.24	2.14	5.71	0.61

**Fig. 1 :** Effect of Potting Media on Plant height at Monthly interval.

lowest. Chlorophyll content, as measured by SPAD (Fig. 3), was highest in T₆ (65.40), followed by T₁ (63.56) and T₅ (61.36). Leaf area (Fig. 4) was maximum in T₆ (85.36 cm²), followed by T₇ (67.81 cm²), and lowest in T₃ (39.86 cm²). The superior performance of T₁ (60% cocopeat, 20% vermicompost, and 20% burnt rice husk) can be attributed to an optimal balance of aeration, moisture retention, and nutrient availability, which promoted better root growth which resulted in better leaf production and a greater number of suckers. On the other hand, T₆ (peat: perlite: vermiculite) supported greater plant height, highest leaf area, and higher chlorophyll content, likely due to its favourable porosity and water-holding properties. Treatments containing higher proportions of burnt rice husk (T₃ –T₅), although beneficial for water retention,

**Fig. 2 :** Effect of Potting Media on Number of leaves (1–6 MAP).

restricted leaf expansion and overall vigour, presumably because of reduced nutrient availability. These findings align with earlier reports highlighting the role of media composition in determining water retention, nutrient supply and plant growth responses (Awang *et al.*, 2010; Singh *et al.*, 2020; Liu *et al.*, 2023; Kaur *et al.*, 2015, Quintero *et al.*, 2013).

Root traits

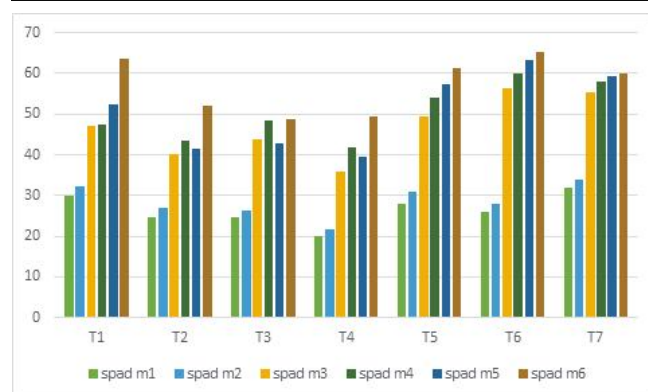
Root traits were significantly affected by media composition (Table 2). The highest root length (842.66 cm), root surface area (350.59 cm²), root volume (11.77 cm³) and average root diameter (1.32 mm) were recorded in T₁, followed by T₆, which supported better root length (825.67 cm) but the root diameters (0.80 mm) was low. T₄ exhibited the lowest root length (338.37 cm), root

Table 2 : Effect of Potting Media on Root Parameters in *Spathiphyllum*.

Treatment Details	Root length (cm)	Root Surface area (cm ²)	Root Volume (cm ³)	Average Root diameter (mm)
T ₁ : 60% CP + 20% VC + 20% BRH	842.66 ^a	350.59 ^a	11.77 ^a	1.32 ^a
T ₂ : 50% CP + 20% VC + 30% BRH	729.87 ^c	210.79 ^b	4.83 ^c	0.91 ^e
T ₃ : 40% CP + 20% VC + 40% BRH	669.14 ^d	208.40 ^c	5.19 ^b	0.98 ^b
T ₄ : 30% CP + 20% VC + 50% BRH	338.37 ^g	102.36 ^g	2.39 ^f	0.94 ^c
T ₅ : 20% CP + 20% VC + 60% BRH	519.07 ^f	151.34 ^e	3.50 ^e	0.92 ^d
T ₆ : Peat : Perlite : Vermiculite (1:1:1)	825.67 ^b	203.59 ^d	4.03 ^d	0.80 ^g
T ₇ : Local nursery media (control)	526.77 ^e	149.45 ^f	3.49 ^e	0.89 ^f
SEm±	0.90	0.53	0.03	0.00
CD (p=0.05)	2.73	1.61	0.10	0.00

Table 3 : Effect of Potting Media on plant nitrogen, Phosphorus and Potassium content in *Spathiphyllum*.

Treatment details	Nitrogen (%)	Phosphorus (%)	Potassium (%)
T ₁ : 60% CP + 20% VC + 20% BRH	4.10 ^a	0.38 ^a	3.58 ^d
T ₂ : 50% CP + 20% VC + 30% BRH	3.81 ^b	0.35 ^b	3.49 ^d
T ₃ : 40% CP + 20% VC + 40% BRH	3.54 ^c	0.32 ^d	3.71 ^c
T ₄ : 30% CP + 20% VC + 50% BRH	3.15 ^d	0.29 ^e	3.89 ^b
T ₅ : 20% CP + 20% VC + 60% BRH	2.73 ^f	0.23 ^g	4.23 ^a
T ₆ : Peat: Perlite: Vermiculite (1:1:1)	3.01 ^e	0.26 ^f	3.21 ^e
T ₇ : Local nursery medium (control)	3.51 ^c	0.33 ^c	3.70 ^c
SEm±	0.023	0.002	0.032
CD (p=0.05)	0.070	0.006	0.098

**Fig. 3 :** Effect of Potting Media Combinations on SPAD readings over monthly intervals (1–6 MAP).

surface area (102.36 cm²), and root volume (2.39 cm³). These observations indicate that T₁ with 60% cocopeat BRH (20%) and vermicompost (20%), provided optimal aeration, nutrient supply, and porosity, promoting root elongation, surface expansion, and biomass accumulation. Singh and Verma (2021) reported that cocopeat-based media enriched with organic amendments significantly improved root growth while Kartika *et al*, (2021) reported root development was primarily associated with improvement in water status and chemical properties in

rice husk biochar-amendment

Nutrient uptake

Media composition significantly influenced nutrient uptake (Table 3). T₁ recorded the highest nitrogen (4.10%) and phosphorus (0.38%), followed by T₂ (3.81% N, 0.35% P), while T₅ exhibited the highest potassium content (4.23%) but the lowest N and P. The results highlight the critical role of substrate composition in nutrient uptake. T₁ (cocopeat (60%), BRH (20%) and vermicompost (20%)) showed superior N and P uptake, which was likely due to the balanced mix of

cocopeat and vermicompost that improved aeration, moisture retention, and mineralization. In contrast, higher K content in T₄ and T₅ can be attributed to the potassium-rich nature of burnt rice husk. Similar trends were reported by Liu *et al*. (2023) and Shilphasree *et al*. (2024) where media composition significantly influenced nutrient accumulation.

Conclusion

Among the tested media, T₁ (60% cocopeat + 20% vermicompost + 20% BRH) proved most effective, supporting enhanced growth, nutrient uptake and root development. While T₆ (peat + perlite + vermiculite) favoured plant height. Incorporating BRH at 20% in the total volume of substrate will be sustainable alternative to conventional substrates for *Spathiphyllum* cultivation.

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